

1 **CLAIMS:**

- 1 1. An apparatus for processing a substrate, comprising:
2 a plurality of vacuum chambers, the vacuum chambers defining a peripheral envelope
3 of space;
4 a plurality of pumps, each of the pumps having an inlet connected to at least one of
5 the vacuum chambers and an outlet exhausting gas to atmospheric pressure and;
6 a system controller, for controlling gas pressure in at least one of the chambers, and
7 the rate of evacuation of gas from the chambers.
- 1 2. The apparatus of claim 1, wherein the plurality of pumps is disposed within the
2 envelope of space defined by the chambers.
3
- 1 3. The apparatus of claim 1, wherein the system controller is programmable to control
2 the gas pressure by changing the speed of one of the pumps in relation to a signal from a
3 chamber pressure gauge according to a programmed set of instructions for processing the
4 substrate.
- 1 4. The apparatus of claim 1, wherein the system controller is programmable to control
2 the rate of evacuation of gas by changing the speed of one of the pumps in relation to a signal
3 from a chamber pressure gauge according to a programmed set of instructions for reducing
4 condensation of moisture in the chamber.
- 1 5. The apparatus of claim 1, wherein the system controller is programmable to control
2 the efficiency of at least one of the pumps by changing the speed of the pump.
- 1 6. The apparatus of claim 5, wherein the system controller is programmable to control
2 the efficiency of at least one of the pumps by changing the speed of the pump between a low
3 speed, a high speed and an idle speed.
- 1 7. The apparatus of claim 6, wherein the low speed is about 30 Hz, the high speed is

2 about 100 Hz and the idle speed is about 30 Hz.

1 8. The apparatus of claim 6, wherein the low speed requires energy of about 500 to 750
2 watts, the high speed requires energy of about 3000 watts and the idle speed requires energy
3 of about 500 watts.

1 9. An apparatus for containing a substrate, comprising:
2 a plurality of components including at least one vacuum chamber, the components
3 defining an peripheral envelope of space; and
4 at least one pump having an inlet connected to the vacuum chamber and an outlet
5 exhausting gas to atmospheric pressure, whereby the pump is locatable within the peripheral
6 envelope of space defined by the components.

1 10. An apparatus for processing a substrate, comprising:
2 a plurality of vacuum chambers defining an envelope of space in a clean room; and
3 at least two pumps, each pump having an inlet connected to at least one of the
4 chambers for evacuating gas in the chamber and an outlet that exhausts the evacuated gas to
5 a pressure approximately equal to atmospheric pressure, the pumps located within the
6 envelope of space defined by the chambers.

1 11. The apparatus of claim 10, wherein the plurality of vacuum chambers includes:
2 at least one process chamber;
3 at least one load-lock chamber; and
4 at least one transfer chamber.

1 12. The apparatus of claim 11, wherein at least one of the process chambers and the load-
2 lock chamber are elevated off of the clean room floor.

1 13. The apparatus of claim 12, wherein each of the pumps is disposed beneath one of the
2 elevated process chambers and a fourth pump is disposed beneath one of the elevated load-
3 lock chambers.

1 14. The apparatus of claim 12, wherein a first transfer chamber is disposed adjacent a
2 second transfer chamber, the first and second transfer chambers having a plurality of process
3 chambers disposed in a radial fashion there around and wherein two of the pumps are each
4 disposed between adjacent process chambers, one pump is disposed beneath a load-lock
5 chamber, and two pumps are disposed each beneath one of the process chambers.

1 15. The apparatus of claim 12, further comprising at least four process chambers and two
2 load-lock chambers connected to the transfer chamber and at least one pump disposed beneath
3 each of the process chambers and at least one pump disposed beneath one of the load-lock
4 chambers.

1 16. The apparatus of claim 15, further comprising two pumps stacked vertically and
2 disposed at least partially beneath one of the load-lock chambers.

1 17. The apparatus of claim 11, further comprising a transfer chamber with at least four
2 process chambers and two load-lock chambers disposed therearound and six pumps disposed
3 at a first end of the envelope beneath a gas supply panel, the pumps substantially within the
4 footprint of the apparatus.

1 18. The apparatus of claim 11, wherein the pumps are each housed in an enclosure, the
2 enclosure including noise and vibration reducing members.

1 19. The apparatus of claim 11, wherein the pumps include movable members to facilitate
2 moving the pumps around a surface of a clean room floor .

1 20. The apparatus of claim 12, wherein two of the pumps are stacked vertically and are
2 at least partially disposed under one of the chambers.

1 21. The apparatus of claim 10, wherein each of the pumps includes an exhaust line and
2 wherein the exhaust lines are bundled together to form a single exhaust bundle.

1 22. The apparatus of claim 21, wherein the exhaust bundle is wrapped in a heater.

1 23. The apparatus of claim 22 wherein the heater includes a conductor carrying electrical
2 current to heat gas within the exhaust lines.

1 24. The apparatus of claim 10 wherein each of the pumps includes an exhaust line and two
2 or more of the exhaust lines are integrated into one common exhaust line for removing
3 exhaust from two or more pumps.

1 25. An apparatus for processing a substrate, comprising:
2 a transfer chamber;
3 a plurality of process chambers connected to the transfer chamber; and
4 a plurality of pumps disposed adjacent the transfer chamber in an alternating
5 relationship with the process chambers within a perimeter of the apparatus as defined by the
6 outermost edges of the chambers.

1 26. The apparatus of claim 25, wherein at least one of the pumps is mounted on another
2 pump.

1 27. A pump for use with a substrate processing apparatus, comprising:
2 an inlet connected to a vacuum chamber and an outlet exhausting gas to atmospheric
3 pressure; and
4 the pump constructed and arranged to operate within an envelope of the apparatus.

1 28. The pump of claim 27, wherein the pump is surrounded by an enclosure, the enclosure
2 having a substantially planar top surface, bottom surface, two side surfaces and two end
3 surfaces, and constructed and arranged to reduce noise and vibration emanating from the
4 pump and surface temperature.

1 29. The pump of claim 27, further including a vacuum chamber disposed above the pump
2 whereby the pump and chamber are housed together in a frame, the pump within the envelope
3 of space defined by the outer perimeter of the vacuum chamber.

1 30. The pump of claim 28, wherein the height, length and width ratio of the enclosure is

2 about 1:2:1.

1 31. The pump of claim 28, wherein the height, length and width ratio of the enclosure is
2 about 2:1:1.

1 32. The pump of claim 28, wherein the noise level of the pump when measured at a base
2 pressure and a distance of 1 meter is equal to or less than 58 dB.

1 33. The pump of claim 28, wherein the pump enclosure has a plurality of machine
2 interfaces, all of which are located on a single surface of the pump enclosure.

1 34. The pump of claim 28, wherein the bottom surface of a first pump enclosure is fixable
2 to a top surface of a second pump enclosure, the pump enclosures thereby stackable.

1 35. The pump of claim 34, wherein the top surface of the second pump enclosure has a
2 plurality of landing indentations, the landing indentations constructed and arranged to receive
3 a plurality of similarly spaced landing protrusions extending from the bottom surface of
4 another pump enclosure.

1 36. The pump of claim 34, wherein the bottom surface of the first pump enclosure
2 includes at least one tab extending downward therefrom, the tab including an aperture there
3 through and wherein the top surface of the second enclosure includes at least one tab
4 projecting upward therefrom, the tab including an aperture there through, whereby when a
5 first pump is stacked upon a second pump, the apertures align to receive a fastener thereby
6 fixing the first and second pumps to each other.

1 37. The pump of claim 28, wherein a first end of the bottom surface of the pump enclosure
2 includes two wheels partially recessed therein, and a second end of the bottom surface of the
3 pump enclosure includes at least one pivoting wheel and a handle assembly attachable to the
4 pump enclosure, the wheels and handle assembly facilitating the movement of the pump along
5 a clean room floor by personnel.

1 38. The apparatus of claim 28, wherein the pump is mountable on a layer of vibration
2 absorbing material, the plate located between and affixed to the bottom surface of the pump
3 enclosure and the clean room floor.

1 39. The pump of claim 27, wherein the pump is a multiple inlet pump operating at least
2 two chambers.

1 40. The pump of claim 28, wherein the pump enclosure includes a ventilation system
2 capable of drawing air through the enclosure from a first end of the enclosure to a second end
3 of the enclosure where the air is exhausted to a ventilation exhaust line.

1 41. The pump of claim 40, wherein the ventilation system further includes a shroud
2 constructed around an exhaust connection of the pump, the shroud in communication with the
3 ventilation exhaust line whereby air around the exhaust connection is captured and exhausted
4 through the ventilation exhaust line.